

CLAIMS

1. A method for solid free-form fabrication of a three-dimensional object, comprising:

5 a) depositing a particulate composition including inorganic phosphate particulates in a defined region;

 b) ink-jetting an aqueous liquid onto a predetermined area of the particulate composition to form hydrated cement in the predetermined area;

 c) hardening the hydrated cement; and

10 d) repeating steps a) through c) such that multiple layers of the cement are formed that are bound to one another, thereby forming the three dimensional object.

2. A method as in claim 1, further comprising the step of removing a
15 portion of the particulate blend that does not form the hydrated cement.

3. A method as in claim 1, wherein the particulate composition includes polymeric particulates.

20 4. A method as in claim 3, wherein the polymeric particulates are selected from the group consisting of 75% to 100% hydrolyzed polyvinyl alcohol powder, polyacrylamide powder, poly(acrylic acid), poly(acrylamide-co-acrylic acid), poly(vinyl alcohol-co-ethylene), poly(vinyl alcohol-co-vinyl acetate-co-itaconic acid), poly(vinyl pyrrolidone), poly(methylmethacrylate-co-methacrylic
25 acid), soluble starch, methylcellulose, and combinations thereof.

5. A method as in claim 1, wherein the aqueous liquid includes a low molecular weight polymer solvated or dispersed therein.

30 6. A method as in claim 5, wherein the low molecular weight polymer has a weight average molecular weight from 200 Mw to 2000 Mw.

7. A method as in claim 1, wherein the aqueous liquid further includes a colorant.

8. A method as in claim 1, wherein the inorganic phosphate particulates
5 have an average particulate size from 10 microns to 80 microns, and wherein the polymeric particulates have an average particulate size from 1 micron to 80 microns.

9. A system for solid free-form fabrication of three-dimensional objects,
10 comprising:

a particulate composition including inorganic phosphate particulates;

a substrate configured for supporting at least a layer of the particulate composition in a defined region; and

an ink-jettable aqueous liquid configured for being jetted in the defined
15 region to hydrate at least a portion of the particulate composition to form a cement.

10. A system as in claim 9, further comprising ink-jet architecture configured for ink-jetting the aqueous liquid onto the particulate blend.

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11. A system as in claim 9, configured for applying multiple layers of cement such that each layer is bound to at least one adjacent layer.

12. A system as in claim 9, wherein the particulate composition further
25 includes polymeric particulates.

13. A system as in claim 12, wherein the particulate polymeric content is selected from the group consisting of 75% to 100% hydrolyzed polyvinyl alcohol powder, polyacrylamide powder, poly(acrylic acid), poly(acrylamide-co-acrylic acid), poly(vinyl alcohol-co-ethylene), poly(vinyl alcohol-co-vinyl acetate-co-itaconic acid), poly(vinyl pyrrolidone), poly(methylmethacrylate-co-methacrylic acid), soluble starch, methylcellulose, and combinations thereof.
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14. A system as in claim 9, wherein the aqueous liquid further includes a low molecular weight polymer solvated or dispersed therein.

5 15. A system as in claim 14, wherein the low molecular weight polymer has a weight average molecular weight from 200 Mw to 2000 Mw.

16. A system as in claim 9, wherein the aqueous liquid further includes a colorant.

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17. A system as in claim 9, wherein the aqueous liquid further includes a shrinkage minimizing agent.

15 18. A system as in claim 9, wherein the aqueous liquid or the particulate composition includes a base.

19. A system as in claim 9, wherein the aqueous liquid or the particulate composition includes an acid.

20 20. A solid three-dimensional composition, comprising multiple layers of cement deposited in contact with one another, each of said multiple layers of cement comprising a particulate composition including inorganic phosphate particulates, said particulate composition being hydrated and hardened by use of an ink-jettable aqueous liquid.

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21. A composition as in claim 20, wherein the particulate composition further includes polymeric particulates selected from the group consisting of 75% to 100% hydrolyzed polyvinyl alcohol powder, polyacrylamide powder, poly(acrylic acid), poly(acrylamide-co-acrylic acid), poly(vinyl alcohol-co-ethylene), poly(vinyl alcohol-co-vinyl acetate-co-itaconic acid), poly(vinyl pyrrolidone), poly(methylmethacrylate-co-methacrylic acid), soluble starch, methylcellulose, and combinations thereof.

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22. A composition as in claim 20, wherein the aqueous liquid includes a low molecular weight polymer solvated or dispersed therein.

5 23. A composition as in claim 20, wherein the hydrated particulate composition includes hydroxyapatite.

24. A composition as in claim 20, wherein the composition is void of pores larger than about 10 microns.

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25. A composition as in claim 20, wherein upon drying, the composition substantially retains its size and form.